

This lesson is part of a larger, comprehensive school garden guide called **Minnesota School Gardens: A Guide to Gardening and Plant Science** developed by Minnesota Agriculture in the Classroom in 2013. The entire guide is available at www.mda.state.mn.us/maitc.



Grade

High School

Materials/Preparation

- ☐ Teacher Material A – Plant Pests – one per teacher
- ☐ Teacher Material B – A Bug's Life – one per teacher
- ☐ Handout A – A Bug's Life – one per student
- ☐ Assessment A – A Bug's Life – one per student
- ☐ Computer with Internet access
- ☐ Notebook paper
- ☐ Writing instruments

Fun Fact

As a result of U.S. Supreme Court case *Nix vs. Hedden*, the Court ruled in 1893 that the tomato was a vegetable so it could be subject to taxes. (The tomato is technically (botanically) a fruit.)

A Bug's Life

Minnesota K-12 Academic Standards

Science	9.4.4.1	Human activity has consequences on living organisms and ecosystems.
Language Arts	9.7.7.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
Language Arts	11.7.7.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Summary/Overview

For this activity, students research common garden pests. Students identify a pest to research, examine its life cycle, and prescribe the best timing to disrupt the reproduction of this pest.

Garden Connection

Insects cause the majority of plant damage. Integrated Pest Management can be used to disrupt the insect's life cycle.

Background Information

Insects are responsible for the majority of plant damage. Pesky bugs chew, suck, and bore into plant material causing stress on plants, which affects the beauty, production, and overall health of the plant.

An Integrated Pest Management (IPM) plan helps you to choose methods best suited to prevent or control pests. IPM plans also prescribe how to monitor pest situations and to determine when pest control methods should be used. The timing for using pest control methods is often based on the life cycle of an insect. Insects are more vulnerable to pesticides and biological treatments at different stages during metamorphosis.



Objectives

- Identify how pests affect crop quality.
- Name several types of plant pests.
- Explain options for pest control.
- Describe the difference between incomplete and complete metamorphosis.

Procedure

Interest Approach

Ask students, “How can pests cause negative effects on plant growth, production, and overall health?”

Have them jot answers on a piece of paper. After a couple minutes, discuss their responses. Add any items students may have missed such as take away resources, eat plant tissue, eat seeds and fruit, bore holes, remove fluids, retard growth, degrade plant tissue quality, and disrupt metabolic processes.

Even though there is a long list of potential pest hazards, there is some good news. Plant damage is often easy to observe, diagnose, and prevent with a little knowledge of pest types, how pests cause damage, how to eradicate or deter pests, and pest life cycles.

Summary of Content and Teaching Strategies

- Present and discuss information on Teacher Material A and Teacher Material B.
- Give students copies of Handout A. They will research the common pests that affect garden plants.
- Students need to research control methods for the various stages of metamorphosis the pest completes. A good research website is the National Pesticide Information Center <http://npic.orst.edu/index.html>. A table in Part 3 is provided to help organize the information related to this portion of the activity.

Review/Summary

Discuss the conclusion questions found on Handout A.

Modifications/Extensions

Have students select a plant pest they have observed in the garden to research in further detail. They should find the following information about their pest: type, methods for breaking the cycle, methods of pest control, most commonly affected plants, and a picture. Display all information on a poster and share with the class.

Sources/Credits

Adapted from: *Curriculum for Agricultural Science Education (2012) Principles of Agricultural Science – Plant*. [Curriculum materials for secondary agricultural education instruction]. Lexington, KY.

Plant Pests

Insects	Mollusks	Nematodes
Vertebrates	Weeds	Plant Disease Agents

Insects

Different kinds of insects based on their eating habits:

- Chewing
- Sucking
- Boring

Weeds *(undesirable plants)*

- Weeds can hinder plants by competing for resources such as water, space, light, and nutrients.
- Any plant can be a weed if it is growing in the wrong place at the wrong time.

Mollusks and Nematodes

- Mollusks include snails and slugs
- Nematodes are soil-borne insects

Plant Disease Agents

- Bacteria, viruses, and fungi

Vertebrates

- Birds
- Rodents

Methods of Pest Control

- **Biological:** Using a living organism, such as a beneficial insect, to control a pest. (Example: lady bugs and parasitic wasps)
- **Chemical:** Herbicides, pesticides, and repellents
- **Cultural practices:** Crop rotation, clean equipment, no-till planting, and quarantine
- **Physical/Mechanical:** Cultivators, hoes, and mowing

A Bug's Life

Insects' Plight

Insects cause billions of dollars of damage to plant crops each year. They are the single greatest cause of financial loss for crop production.

Breaking the cycle

- When controlling plant pests, knowledge of its life cycles is vital.
- Pests become a threat at certain stages of their life cycles. For example, aphids are most destructive in the adult stage because they suck plant nutrients from leaves.
- Pests are often best controlled at certain stages of their life cycles. Adult aphids can be sprayed off sturdy plants with a strong stream of water. In the process, their sucking mouthparts break and they are unable to feed.
- Eliminating a pest before reproduction is vital to population control.
- Rotating the location in which fruits and vegetables are planted is one way to break life cycles.

How Insects Eat at Various Stages

- Adult insects eat vegetation or suck plant-tissue fluids.
- Larvae insects cause damage through boring into stalks and feeding on young plants or roots. For example, rootworm larvae eat on corn roots while rootworm adult eats on corn silk.

Insect Metamorphosis

As insects go through stages of development from eggs to an adult, their transformation is called metamorphosis. Two types of metamorphosis to know are:

- Incomplete
- Complete

Incomplete Metamorphosis

Also known as gradual metamorphosis.

Example: Grasshopper Transformation

Egg → Early Nymph → Late Nymph → Adult

The insect has the same eating habits at all stages.

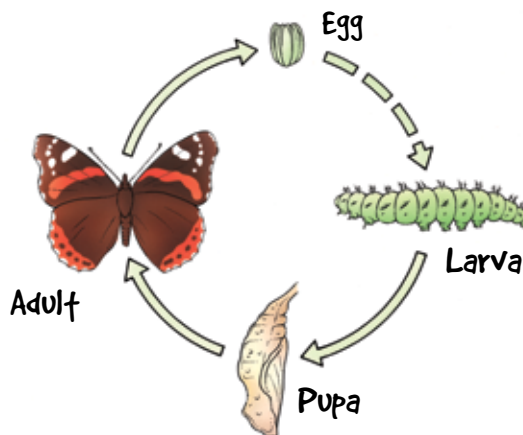
Complete Metamorphosis

Complete metamorphosis has an extreme variation of anatomical features:

Example: Butterfly Transformation

Egg → Larva → Pupa → Adult

Larva and adult stages have very different eating habits.



References

- Herren, R. V. (2004). *The science of agriculture: A biological approach* (2nd ed.). Albany, NY: Delmar.
- Reiley, H. E., & Shry, C. L. (2007). *Introduction to horticulture* (7th ed.). Clifton Park, NY: Delmar.

Name _____



A Bug's Life

Part 1. Research Pests

Find information pertaining to the different kinds of pests that commonly are a problem for garden plants. First, list common pests by category. Second, briefly describe how each pest negatively affects plants.

Table 1. Pest Inventory		
Pest	Category	How pest negatively affects plants
Insect		
Weed		
Mollusk		
Vertebrate Animal		
Other		

Name _____



Part 2. Research an Insect Pest

From the list in Part 1, choose an insect pest that has the potential to damage plants in your garden and research its lifecycle. In the space below, draw a circle diagram representing the cycle of metamorphosis of this insect.

Name of Insect

Part 3. Research Methods of Control

List the stages of metamorphosis identified in Part 2 in the appropriate column below. Using the Internet, research appropriate types of treatment for each stage. Place an "X" in the cell of the table if the treatment is appropriate to control your pest. Indicate the name of the treatment in the space below the "X". In situations where the insect has no control measure or stage of metamorphosis, place a "NA" in the cell.

Name of Insect _____

Stage of Metamorphosis	Biological Treatment	Chemical Treatment	Cultural Practices	Physical/Mechanical Treatment
1.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

List sources for the information you gathered from your research.

conclusion

Why is knowledge of the pest’s life cycle valuable to producers?

List the four stages of incomplete and the four stages of complete metamorphosis for insects.

Incomplete Metamorphosis:	Complete Metamorphosis:

Why are most adult insects difficult to control compared to eggs or larva?

How do incomplete and complete metamorphosis differ?

Name _____



A Bug's Life

1. List two examples of how pests affect crop quality.

2. Name two types of plant pests.

3. Explain two options for pest control.

4. Describe the difference between incomplete and complete metamorphosis.
